

1 **CLAIMS**

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3 1. A body protecting device for wearing by a user
4 comprising an array of energy absorbing cells,

5 wherein each cell comprises a tube,

6 and wherein substantially each tube has a side
7 wall which is near or adjacent to the side wall of
8 at least another tube,

9 and wherein substantially each tube is
10 configured such that the orientation of the tube is
11 substantially maintained when a load is applied
12 parallel to the axis of the tube.

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14 2. A body protecting device as claimed in Claim 1,
15 wherein the tube has a cylindrical or conical
16 structure.

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18 3. A body protecting device as claimed in Claim 1
19 or 2, wherein the body protecting device comprises a
20 safety helmet.

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22 4. A body protecting device as claimed in any
23 preceding claim, wherein substantially each tube has
24 a side wall which abuts the side wall of at least
25 another tube.

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27 5. A body protecting device as claimed in any
28 preceding claim, wherein substantially each tube has
29 a side wall which is connected to the side wall of
30 at least another tube.

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1 6. A body protecting device as claimed in Claim 5,
2 wherein substantially each tube has a side wall
3 which is connected to the side wall of at least
4 another tube by an adhesive.

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6 7. A body protecting device as claimed in Claim 5
7 or 6, wherein substantially each tube has a side
8 wall which is connected to the side wall of at least
9 another tube substantially along the length of the
10 tube.

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12 8. A body protecting device as claimed in Claim 5,
13 wherein substantially each tube has a side wall
14 which is welded or fused to the side wall of at
15 least another tube.

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17 9. A body protecting device as claimed in Claim 8,
18 wherein one or more tubes are formed from an inner
19 core comprising a first material and an outer core
20 comprising a second material.

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22 10. A body protecting device as claimed in Claim 9,
23 wherein the second material has a lower melting
24 temperature than the first material.

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26 11. A body protecting device as claimed in any
27 preceding claim, wherein substantially each tube is
28 near or adjacent to at least three other tubes.

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30 12. A body protecting device as claimed in any
31 preceding claim, wherein substantially each tube is
32 near or adjacent to six other tubes.

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2 13. A body protecting device as claimed in any
3 preceding claim, wherein each tube has a diameter of
4 between 2 and 8 mm.

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6 14. A body protecting device as claimed in any
7 preceding claim, wherein each tube has a diameter of
8 about 6 mm.

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10 15. A body protecting device as claimed in any
11 preceding claim, wherein the thickness of the side
12 wall of each tube is less than 0.5 mm.

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14 16. A body protecting device as claimed in any
15 preceding claim, wherein the thickness of the side
16 wall of each tube is between 0.1 and 0.3 mm.

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18 17. A body protecting device as claimed in any
19 preceding claim, wherein the length of each tube is
20 less than 50 mm.

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22 18. A body protecting device as claimed in any
23 preceding claim, wherein the length of each tube is
24 between 30 and 40 mm.

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26 19. A body protecting device as claimed in any
27 preceding claim, wherein the array of energy
28 absorbing cells is provided as an integral material.

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30 20. A liner for a body protecting device for
31 wearing by a user, the liner comprising:

1 a first material having an array of energy
2 absorbing cells, wherein each cell comprises a tube,
3 and wherein substantially each tube has a side wall
4 which is near or adjacent to the side wall of at
5 least another tube, and wherein substantially each
6 tube is configured such that the orientation of the
7 tube is substantially maintained when a load is
8 applied parallel to the axis of the tube.

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10 21. A liner as claimed in Claim 20, wherein the
11 body protecting device comprises a safety helmet.

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13 22. According to a third aspect of the present
14 invention, there is provided a body protecting
15 device comprising:

16 a first material bonded to a second material
17 using an adhesive, wherein the adhesive has a melt
18 temperature which is lower than the melt temperature
19 of the first and second material.

20
21 23. The body protecting device of Claim 22, wherein
22 the first and second materials are in a softened
23 state at the melt temperature of the adhesive.

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25 24. The body protecting device of Claim 22 or 23,
26 wherein the first material is one of a
27 polycarbonate, polypropylene, polyetherimide,
28 polyethersulphone or polyphenylsulphone material.

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30 25. The body protecting device of any of Claims 22
31 to 24, wherein the second material is a plastics
32 material.

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2 26. The body protecting device of Claim 25, wherein
3 the second material is a fibre reinforced plastics
4 material.

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6 27. The body protecting device of any of Claims 22
7 to 26, wherein the adhesive is a thermoplastic.

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9 28. The body protecting device of Claim 27, wherein
10 the adhesive is a polyester based material.

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12 29. The body protecting device of any of Claims 22
13 to 28, wherein the melt temperature of the adhesive
14 is less than 180°C.

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16 30. The body protecting device of Claim 29, wherein
17 the melt temperature of the adhesive is between
18 120°C and 140°C.

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20 31. The body protecting device of Claim 30, wherein
21 the body protecting device is heated during forming
22 to between 155°C and 160°C.

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24 32. The body protecting device of any of Claims 22
25 to 31, further comprising a third material, wherein
26 the first material interposes the second and third
27 materials, and wherein the first material is bonded
28 to the third material using the adhesive.

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30 33. The body protecting device of any of Claims 22
31 to 32, wherein the first material has an array of
32 energy absorbing cells, each cell comprising a tube.

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2 34. A method of forming a body protecting device
3 comprising:

4 bonding a first material to a second material
5 using an adhesive, wherein the adhesive has a melt
6 temperature which is lower than the melt temperature
7 of the first and second material.

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9 35. The method of Claim 34, including selecting
10 first and second materials which are in a softened
11 state at the melt temperature of the first material.

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13 36. The method of Claim 34 or 35, including heating
14 the body protecting device during forming to between
15 155°C and 160°C.

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17 37. The method of any of Claims 34 to 36, including
18 bonding the first material to a third material using
19 the adhesive.

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21 38. The method of any of Claims 34 to 37, wherein
22 the first material has an array of energy absorbing
23 cells, each cell comprising a tube.

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